# ABSTRACT

The major objective of present investigation is to develop a better understanding of constitutive behaviour of coarse grained soils and rockfills using discrete element approach This problem is quite important with reference to characterising the behaviour of coarse grained soils considering the fact that the existing methodologies can not directly explain the fundamental aspects involved in existing modelling techniques such as parallel gradation technique and the effect of confining pressure, particle size, and gradation An examination from micromechanical considerations considering the particulate nature of the medium is a viable tool to understand the constitutive behaviour of coarse grained soils and rockfills The numerical modelling is based on a particulate mechanics approach using **Discrete Element Modelling (DEM)**, which explicitly accounts for the discontinuous nature of aggregate material Discrete element method is used as a tool to investigate the physics of granular material behaviour and the effects of particle sizes and their distributions on their mechanical behaviour

Chapter 1 describes the general background to the problem and lists out the objectives of the investigation An outline of the thesis is also presented in this chapter Chapter 2 presents a literature review that includes developments in the study of constitutive behaviour of coarse grained soils and rockfills that are important to the current study The literature review brings out the current understanding of the effect of confining pressure, particle size, and particle distribution/gradation on the strength and volume change behaviour of coarse grained granular materials Chapter 3 involves a brief introduction to discrete element modelling and micromechanics of granular media A simple validation of discrete element method is also presented in this chapter Micro to macro relationships developed based on the fabric of granular media are also presented Chapter 4 describes the behaviour of assemblies of cohesionless granular particles under hydrostatic and non-hydrostatic loading Micromechanical equations relating microscopic parameters to macroscopic behaviours are validated during hydrostatic as well as non-hydrostatic loading tests The effect of contact properties such as particle stiffness and friction coefficient on the constitutive behaviour of coarse grained granular media is also characterised using biaxial tests Chapter 5 reports the effect of confining pressure, particle size and gradation on the bulk mechanical behaviour of coarse grained soils and rockfills Micromechanical explanations to the macroscopic behaviours are given in terms of the force and fabric anisotropy coefficients The effect of particle size and gradation on the volume change behaviour in hydrostatic compaction tests is also presented with physics based explanations from grain scale level observations Chapter 6 summarises the major conclusions drawn from the current investigations and presents the recommendations for further research In appendix I, the details of finite difference formulations of DEM and a brief description of the program DISC is presented